

Application No. 09/589,299
Filed: June 7, 2000
TC Art Unit: 2675
Confirmation No.: 9186

REMARKS

Applicant thanks the Examiner for the indication of allowable subject matter in claims 13-20, 28-35 and 39-41.

A. Independent claim 1 and claims dependent therefrom.

Claims 1-7, 9-11, 28-29, and 37 have been rejected under 35 U.S.C. § 103(a) over Amafuji et al. (US 6,292,158 B1) in view of Rallison et al. (US 5,949,583).

This rejection is the same rejection set forth previously in the Final Office Action dated March 22, 2004. In the section "Response to Arguments" in the present Office Action, the Examiner states that he "disagrees with applicant's arguments because of the same reasons set forth previously." (Office Action, page 17) Applicant, however, addressed these reasons in the response dated December 23, 2004. This response has not been addressed by the Examiner.

For the Examiner's convenience, this response is set forth again below. Consideration of this response is respectfully requested.

Amafuji has been cited for disclosing a compact display device 201 for transmitting an image to a user's eye. Amafuji discloses an off-axis optical system. Rallison has been cited for teaching an on-axis or axial optical system. The Examiner asserts that it would be obvious to combine the on-axis or axial system of Rallison with Amafuji, the motivation being to provide a head mounted display (HMD) that produces virtual images with a minimal amount of aberrations, therefore allowing for better image quality and light efficiency. (Present Office Action, page 3; Final Office Action, page 3)

In response to Applicant's arguments, the Examiner states (at pages 22-23 of the Final Office Action):

The examiner is not using the entire system, i.e. goggles etc., of Rallison but only the on-axis part to replace the off-axis system of Amafuji. Thus it would be obvious since both references pertain to a head mounted display they can be used with each other and in this case that is the purpose by replacing the off-axis system of Amafuji with the on-axis system of Rallison.

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Thus, the Examiner asserts that the off-axis system of Amafuji is "replaced" with the on-axis system of Rallison.

Applicant respectfully submits that such a "replacement" would not be obvious. Substantial reconstruction would be required to effect such a replacement. Furthermore, it is not clear what structural form such a replacement would take.

An axial system requires an eyepiece in front of the face. Such a system is generally characterized by more weight suspended in front of the face. If the weight is high, the center of gravity (CG) is located too far forward, which is a problem. It also might present a safety hazard to the eye. A non-axial system such as that of Amafuji obviates these problems. In a non-axial system, the optically complex system is moved away from the face. However, it is found in practice that the total weight of such a system is still high. Also, despite the center of gravity disadvantages, axial systems have far less distortion than non-axial systems.

The present invention provides an axial system that reduces the total weight, which is not an obvious task. Claim 1 recites a head-mountable support fixture comprising an elongated member having a first end and a second end. The projection system is attached at the first end of the elongated member of the support fixture and that the eyepiece assembly is attached to the second end of the elongated member of the support fixture.

The Examiner asserts that the non-axial system of Amafuji is "replaced" with the axial system of Rallison. The Rallison axial system, however, does not employ an elongated member having a projection system attached at one end and an eyepiece assembly attached at an opposite end, as the Examiner acknowledges (Final Office Action, p. 23). The Examiner does not, however, explain how the Rallison axial system would be employed in the Fig. 5 embodiment of Amafuji, other than by a "replacement."

More particularly, Rallison discloses an image generator 2 mounted in a visor arrangement to extend outwardly from the forehead area of the wearer. See Figs. 3 and 4. An optical path 6 from the image generator extends downwardly to a fold mirror 1 and outwardly to a reflective combiner 4, where it is then reflected back toward the eye. One of skill in the art would not try to rearrange the optical components of Rallison to place the image generator on one end of an elongated member and the optical components on the other end or to fit these components into the embodiment of

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Amafuji's Fig. 5, which is mounted on the side of the user's head. There is no teaching in Amafuji or Rallison as to how one of skill in the art would modify the Fig. 5 embodiment of Amafuji into an axial system. In any event, substantial reconstruction would be required to do so, more than a mere "replacement." Accordingly, claim 1 and the claims dependent therefrom are believed to be patentable over Amafuji in view of Rallison.

B. Independent claim 21 and the claims dependent therefrom.

Claims 21-25, 28-29, and 43 have been rejected under § 103(a) over Amafuji in view of Heacock et al. (US 5,539,422). Reconsideration and withdrawal of this rejection is respectfully requested for the following reasons.

Amafuji has been cited for disclosing a compact display device 201 for transmitting an image to a user's eye. Heacock has been cited for teaching a display device eyepiece assembly including a solid optical material having a selected index of refraction, and external surface and an internal reflective surface. The Examiner asserts that it would have been obvious to combine the eyepiece of Heacock with the display device of Amafuji. The Examiner asserts that a suggestion or motivation for making this combination is to provide a better eye assembly for producing more efficient images that would entitle the image to have higher contrast, resolution, luminance and cleanliness. (Office Action, page 8)

The present invention relates to a non-axial optical approach, in which a form of Mangin mirror is used to reduce the angle of incidence on an eyepiece mirror, leading to a reduction in off-axis aberrations. See, for example, Applicant's Specification, page 10, line 20, to page 11, line 15, and Fig. 7. Independent claim 21 recites, among other things, that the eyepiece assembly comprises a non-axial optical system including a modified Mangin mirror comprising a solid optical material having an external entrance and exit surface and an internal reflective surface. The material is arranged and has an index of refraction selected so that light from the projection system incident on the external surface is refracted as the light propagates into the material and light within the material is reflected off the internal reflective surface and is refracted at the external surface as the light exits the material. In this manner, off-axis aberrations can be reduced.

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Heacock does not disclose a modified Mangin mirror as specified in claim 21. Accordingly, claim 21 and the claims dependent therefrom are believed to be patentable over Amafuji in view of Heacock.

C. Remaining dependent claims.

Claim 8 has been rejected under § 103(a) over Amafuji and Rallison and further in view of Taniguchi et al. (US 6,023,253). This claim is believed to be patentable for the reason set forth with respect to claim 1 and no further comment thereon is believed necessary at this time.

Claim 12 has been rejected under § 103(a) over Amafuji and Rallison and further in view of Ronzani et al. (US 5,844,656). This claim is believed to be patentable for the reason set forth with respect to claim 1 and no further comment thereon is believed necessary at this time.

Claims 26-27 have been rejected under § 103(a) over Amafuji and Heacock and further in view of Ronzani. These claims are believed to be patentable for the reasons set forth above with respect to claim 21, and no further comment thereon is believed necessary at this time.

Claims 30-32 have been rejected under § 103(a) over Amafuji and Rallison in view of Lebby et al. (US 5,469,185). Claims 30-32 have also been rejected under § 103(a) over Amafuji and Heacock in view of Lebby. These claims are believed to be patentable for the reasons set forth above with respect to claims 1, 13, or 21, and no further comment thereon is believed necessary at this time.

Claims 33-35 have been rejected under § 103(a) over Amafuji and Rallison in view of Fan et al. (US Pat. No. 5,815,126). Claims 33-35 have been further rejected under § 103(a) over Amafuji and Heacock in view of Fan. These claims are believed to be patentable for the reasons set forth above with respect to claims 1, 13, or 21, and no further comment thereon is believed necessary at this time.

Claim 36 has been rejected under § 103(a) over Amafuji and Rallison in view of Newman et al. (US 5,844,824). This claim is believed to be patentable for the reasons set forth above with respect to claim 1, and no further comment thereon is believed necessary at this time.

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Claim 38 has been rejected under § 103(a) over Amafuji and Rallison in view of Horiuchi (US 6,304,234 B1). This claim is believed to be patentable for the reasons set forth above with respect to claim 1, and no further comment thereon is believed necessary at this time.

Claim 42 has been rejected under § 103(a) over Amafuji and Heacock in view of Newman. This claim is believed to be patentable for the reasons set forth above with respect to claim 21, and no further comment thereon is believed necessary at this time.

Claim 44 has been rejected under § 103(a) over Amafuji and Heacock in view of Horiuchi. This claim is believed to be patentable for the reasons set forth above with respect to claim 21, and no further comment thereon is believed necessary at this time.

D. Conclusion

In view of the above amendment and remarks, all claims are believed to be in condition for allowance, and reconsideration and indication thereof are respectfully requested. The Examiner is encouraged to telephone the undersigned attorney to discuss any matter that would expedite prosecution of the present application.

Respectfully submitted,

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